

CLAIMS

1. An image recognition system that recognizes motions of players of a sport playing between areas partitioned by an obstacle such as a net from a content of its on-air program,
5 of its material video before broadcasted, or recorded by a recording media such as a VTR, and characterized by comprising
a visual information obtaining part that obtains visual information on which a motion of the player in at least one
10 area during a match is shown from the content,
an occlusion state determining part that determines whether or not a used material such as a ball that moves between the areas included in the visual information obtained by the visual information obtaining part and that is an object to
15 count the score of the relevant sport is in a state being hidden by a predetermined object body,
an impact time information specifying part that specifies an impact time when the used material is hit based on an occlusion start time when the occlusion state determining
20 part determines that the used material changes its state from not being hidden by the object body to being hidden by the object and an occlusion release time when the occlusion state determining part determines that the used material changes its state from being hidden by the object body to
25 not being hidden by the object,
a rule information storing part that stores rule information to conduct the relevant sport, and
an image content recognizing part that recognizes an image

content including the motion of the player shown by the visual information based on the visual information obtained by the visual information obtaining part, a position of the used material at the impact time specified by the impact
5 time information specifying part and the rule information stored in the rule information storing part.

2. The image recognition system described in claim 1, and characterized by that the occlusion state determining part
10 comprises a distance determining part that determines whether or not the used material locates within a predetermined distance from the object body and an occlusion start and release time specifying part that specifies a moment when the distance determining part determines that
15 the used material locates within the predetermined distance from the object body and the used material changes its state from not being hidden by the object body to being hidden by the object body as the occlusion start time and that specifies a moment when the distance determining part
20 determines that the used material locates within the predetermined distance from the object body and the used material changes its state from being hidden by the object body to not being hidden by the object body as the occlusion release time.

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3. The image recognition system described in claim 1 or 2, and characterized by that the impact time shown by t_a , the occlusion start time shown by t_0 and the occlusion release

time shown by t_1 have a relationship shown by the following expression (Expression 1)

$$\text{(Expression 1) } t_a = a \times t_0 + (1-a) \times t_1$$

where coefficient a is $0 \leq a \leq 1$

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4. The image recognition system described in claim 1, 2 or 3, and characterized by that the visual information obtaining part comprises a domain element extracting part that extracts used facilities information such as the obstacle
10 like the net or a boundary line showing a boundary between the areas and outside the areas, player position information showing a position of the player and used material information showing the used material that moves between the areas and that becomes the object to count the score of the
15 relevant sport from the visual information.

5. The image recognition system described in claim 4, and characterized by that the player position information is position information showing a region including the player
20 and a tool that the player always holds and uses during the match.

6. The image recognition system described in claim 4 or 5, and characterized by that the domain element extracting part
25 extracts the player position information from the visual information based on the used facilities information extracted by the domain element extracting part.

7. The image recognition system described in claim 4, 5 or 6, and characterized by that the domain element extracting part extracts the used material information from the visual information based on the used facilities information and the player position information extracted by the domain element extracting part.

8. The image recognition system described in claim 4, 5, 6 or 7, and characterized by that the used facilities information, the player position information, the used material information and the rule information are based on knowledge regarding a sport item to be a target to extract the image.

9. The image recognition system described in claim 1, 2, 3, 4, 5, 6, 7 or 8, and characterized by comprising an audio information obtaining part that obtains audio information synchronous with the visual information, such as an impact sound generating at a moment when the used material such as the ball that moves between the areas and that is an object to count the score of the relevant sport is hit from the content, wherein the impact time information specifying part specifies the impact time based on a combination of the occlusion start time and the occlusion release time and the audio information obtained by the audio information obtaining part.

10. The image recognition system described in claim 9, and

characterized by that the impact time information specifying part specifies a time when the audio information shows a value bigger than a predetermined level as the impact time.

- 5 11. The image recognition system described in claim 9 or 10, and characterized by that the audio information obtaining part comprises a filtering part that passes a predetermined frequency band and the audio information is the information that has passed through the filtering part.

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12. The image recognition system described in claim 11, and characterized by the filtering part consists of a band-pass filter.

- 15 13. The image recognition system described in claim 9, 10, 11 or 12, and characterized by that the impact time information specifying part specifies the impact time based on an impact sound candidate data having a predetermined time including the impact sound extracted from the audio
20 information.

14. The image recognition system described in claim 9, 10, 11 or 12, and characterized by that multiple pieces of impact sound candidate data are extracted from the audio
25 information so that an impact sound candidate data at one time and an impact sound candidate data at its subsequent time have a time that overlaps each other and the impact time information specifying part specifies the impact time

based on the multiple pieces of the impact sound candidate data.

15. The image recognition system described in claim 14, and
5 characterized by that each of the multiple pieces of the
impact sound candidate data is arranged to have an identical
data length and the multiple pieces of the impact sound
candidate data are arranged to be extracted from the audio
information at intervals of a certain period.

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16. The image recognition system described in claim 9, 10,
11, 12, 13, 14 or 15, and characterized by comprising an
impact sound pattern information storing part that stores
impact sound pattern information that is a patternized sound
15 change due to a state under which the used material is hit
by the tool such as a racket that the player always holds
and uses during the match, wherein the impact time
information specifying part specifies the impact time based
on the impact sound pattern information stored in the impact
20 sound pattern information storing part and the audio
information.

17. An image recognition system that recognizes motions of
players of a sport playing between areas partitioned by an
25 obstacle such as a net from a content of its on-air program,
of its material video before broadcasted, or recorded by a
recording media such as a VTR, and characterized by
comprising

a visual information obtaining part that obtains visual information on which a motion of the player in at least one area during a match is shown from the content,
an occlusion state determining part that determines whether
5 or not a used material such as a ball that moves between the areas included in the visual information obtained by the visual information obtaining part and that is an object to count the score of the relevant sport is in a state being hidden by a predetermined object body,
10 an impact time information specifying part that specifies an impact time when the used material is hit based on an occlusion start time when the occlusion state determining part determines that the used material changes its state from not being hidden by the object body to being hidden by
15 the object and an occlusion release time when the occlusion state determining part determines that the used material changes its state from being hidden by the object body to not being hidden by the object, and
an image content recognizing part that recognizes an image
20 content including the motion of the player shown by the visual information based on the visual information obtained by the visual information obtaining part and a position of the used material at the impact time specified by the impact time information specifying part.

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18. The image recognition system described in claim 17, and characterized by comprising an audio information obtaining part that obtains audio information synchronous with the

visual information, such as an impact sound generating at a time when the used material such as the ball that moves between the areas and that is an object to count the score of the relevant sport is hit from the content, and the

5 impact time information specifying part specifies the impact time based on a combination of the occlusion start time and the occlusion release time and the audio information obtained by the audio information obtaining part.

10 19. An image recognition program that is a program activating an image recognition system that recognizes motions of players of a sport playing between areas partitioned by an obstacle such as a net from a content of its on-air program, of its material video before broadcasted,
15 or recorded by a recording media such as a VTR by operating a computer, and characterized by making the computer function as

a visual information obtaining means that obtains visual information on which a motion of the player in at least one
20 area during a match is shown from the content,
an occlusion state determining means that determines whether or not a used material such as a ball that moves between the areas included in the visual information obtained by the visual information obtaining means and that is an object to
25 count the score of the relevant sport is in a state being hidden by a predetermined object body,
an impact time information specifying means that specifies an impact time when the used material is hit based on an

occlusion start time when the occlusion state determining means determines that the used material changes its state from not being hidden by the object body to being hidden by the object and an occlusion release time when the occlusion state determining means determines that the used material changes its state from being hidden by the object body to not being hidden by the object,

a rule information storing means that stores rule information to conduct the relevant sport, and

an image content recognizing means that recognizes an image content including the motion of the player shown by the visual information based on the visual information obtained by the visual information obtaining means, a position of the used material at the impact time specified by the impact time information specifying means and the rule information stored in the rule information storing means.

20. An image recognition program that is a program activating an image recognition system that recognizes motions of players of a sport playing between areas partitioned by an obstacle such as a net from content of its on-air program, of its material video before broadcasted, or recorded by a recording media such as a VTR by operating a computer, and characterized by making the computer to function as

a visual information obtaining means that obtains visual information on which a motion of the player in at least one area during a match is shown from the content,

an occlusion state determining means that determines whether or not a used material such as a ball that moves between the areas included in the visual information obtained by the visual information obtaining means and that is an object to

5 count the score of the relevant sport is in a state being hidden by a predetermined object body,

an impact time information specifying means that specifies an impact time when the used material is hit based on an occlusion start time when the occlusion state determining

10 means determines that the used material changes its state from not being hidden by the object body to being hidden by the object and an occlusion release time when the occlusion state determining means determines that the used material changes its state from being hidden by the object body to

15 not being hidden by the object, and

an image content recognizing means that recognizes an image content including the motion of the player shown by the visual information based on the visual information obtained by the visual information obtaining means and a position of

20 the used material at the impact time specified by the impact time information specifying means.